Variables and Open Sentences

Reporting Category Patterns, Functions, and Algebra

Topic Describing the concept of variable, writing open sentences, and creating problem situations, using variables

Primary SOL 5.18 The student will

a) investigate and describe the concept of variable;
b) write an open sentence to represent a given mathematical relationship, using a variable;
c) model one-step linear equations in one variable, using addition and subtraction; and
d) create a problem situation based on a given open sentence, using a single variable.

Materials

- Writing Open Sentences activity sheet (attached)
- Index cards
- Magazines or newspapers
- Glue sticks

Vocabulary

variable, variable expression, open sentence

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Write *"n* + 3" on the board, and ask students what this means. Lead a class discussion to define *variable* as "a symbol expressed as a box, letter, or other symbol representing an unknown quantity." Explain that a mathematical expression that includes a variable is called a *variable expression.*
2. Show that this variable expression can be written in numerous ways, such as *c* + 3, ___ + 3, or ☐ + 3. Ask students to brainstorm different variables that can be used for the unknown quantity in this expression. List these on the board.
3. Explain that the expression *n* + 3 can represent a variety of situations, such as "some books plus 3 more." Ask students whether they can think of situations in which *n* + 3 might be used. Using the Think-Pair-Share strategy, ask students to think of situations that describe this expression. Have pairs share some ideas with the class.
4. Write *n* + 3 = 8 on the board. Ask how this is different from the variable expression we had before. (Now there is an equal sign and the number 8.) Explain that this variable expression with an equals sign is called an "open sentence." An *open sentence* is an equation that has a variable.
5. Ask students to create a situation that represents this open sentence. With the variable expression *n* + 3, our example was "some books and 3 more"; how might we complete this situation to match the equation *n* + 3 = 8? Allow volunteers to share ideas. (A sample answer might be, "Some books and 3 more equals a total of 8 books.") Have students make

a list of as many situations as they can think of in two minutes and then share with the class.

6. Have students work in pairs to complete the Writing Open Sentences activity sheet (attached). When finished, have pairs compare answers with other pairs.

Assessment

- **Questions**
  - What is a variable? How are variables used? Give examples.
  - What does the open sentence $v \times 6 = 36$ mean? Explain in pictures, symbols and numbers, and words.
- **Journal/Writing Prompts**
  - Using the variable *r* and the numbers 4 and 12, write 4 different open sentences, one for each of the 4 operations. Create a situation for each open sentence, and draw a picture to describe each.
  - Write a story that revolves around the variable expression $t - 5 = 6$. Include characters, a setting, and a plot that includes a problem encountered by the main character.
- **Other**
  - What is the difference between $m + 3$ and $3 + m$? Explain in pictures and words.
  - What is the difference between $k \div 4$ and $4 \div k$? Explain in pictures and words.

Extensions and Connections (for all students)

- Have students play an "I Have, Who Has" game**.** Prepare cards that have a statement and a question; for example, "I have 4 + n. Who has 15 more than a number?" Each card should have an answer to a previous card, with the last card being the question that is answered with the first card. Give one card to each student. One student begins by reading his or her question. All students must listen and see if their answer statement matches. If it does, then that student reads the answer on their card and the new question. Play continues until the student who began the game has the answer on his or her card.
- Make a concentration/memory game. Prepare cards with a problem situation to match with an open sentence. Use all operations and different variables such as letters, boxes, or other symbols.

Strategies for Differentiation

- Have students complete all activities with a partner. Encourage discussion between partners.

Writing Open Sentences

What is a **variable***?*

When writing open sentences, read the situation being described, and focus on the operation used.

A box of cookies and four extra equals 30 cookies.

What operation is used? _____
What variable will you use?_____
What is the known number? _____
Write the open sentence: _____

Three full boxes of cookies equals 15 cookies.

What operation is used? _____
What variable will you use?_____
What is the known number? _____
Write the open sentence: _____

A full box shared among four people equals 6 cookies per person.

What operation is used? _____
What variable will you use?_____
What is the known number? _____
Write the open sentence: _____

A box of cookies minus four cookies equals 22 cookies.

What operation is used? _____
What variable will you use?_____
What is the known number? _____
Write the open sentence: _____